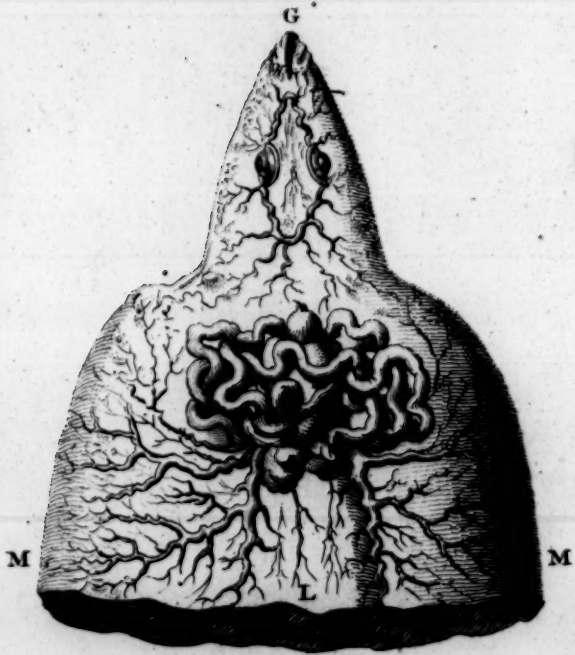




*Of an Animalcule or small living Creature, which is sometimes found in
the livers of Sheep and other beasts.*

TO make my observations on this subject the more intelligible, I shall place them in the following order: First, as to the shape and make of this animalcule; Secondly, the part of the intestines where it is found; Thirdly, its numbers, and the manner of its propagation; and Fourthly, how these creatures, and other animalcules of a similar nature, by fixing themselves in the liver and other internal parts of the body, can produce certain diseases, and their fatal consequences.

First, as to the shape and size of this creature, and its similitude to other known animals; it bears a near resemblance (in miniature) to our sole or flounder, as appears by *fig. A*, which represents it of the size it is commonly found; this figure shews the back or prominent side; and *fig. B*, the belly, or flat side of it. *C* is one of the young of the same species, shewing the back, *D* the belly of the same; *E* and *F* are figures of the same creature somewhat magnified, and shewn in the positions before mentioned.

These animals are not often seen alive, because the disease they produce does not always shew itself by outward tokens, and the beast afflicted with them, sometimes seems fat and in good health, and then the liver is not perhaps examined till sometime after the beast is killed; and these creatures cannot endure cold, but if by being exposed to it they are deprived of motion, they will revive, if the liver be held in a warm hand or put into warm water. Their motion is undulating or wriggling like that of the fishes before mentioned, their colour a yellowish brown, the belly quite flat, and

(b)

much paler coloured than the back, the skin rough and covered with prickles or points, and so transparent, that the bowels and vessels may plainly be seen on both sides. The head (which is shewn considerably magnified, at letter G,) is of a pointed form, plano-convex, that is, rounding above and flat below, the mouth projecting, open, and of an oval shape, nearly in fashion like a carp. The eyes, which are pictured separately at H and I, are very prominent, and surrounded with a cartilaginous or gristly ring, which is shewn at K, and they are placed, as we see in many flat fishes, both on one side of the back, with a division between them.

The heart is so near to the head, and the bowels so closely conjoined to the heart, that I question whether there is any thing properly to distinguish the head from the rest of the body, which yet in most animals are separate and distinct. From the heart arise two vessels spreading over the whole body, with a wide space between them, extending almost the whole length of the back, as represented at letter L, and between these vessels are many smaller ones, as shewn at M, which are so minute that no moisture can be discovered within them. I observed in the larger vessels two sorts of juices, namely, in some a yellowish brown, and sometimes a kind of purple; in others a pale green, both of a glutinous or slimy nature, and yet flowing in the vessels (even after the death of the animal,) towards the heart, if held up by the tail, and back again, upon the head being raised.

The excretory duct, or passage of the bowels, is in an unusual place, being on the right side of the body, close under the head, for which reason the intestines are as it were, crowded together in an heap. There is a small protuberance at the beginning of the bowels, which I take to be the liver, and between this and the bowels, I find in all of those animalcules which I have examined, an innumerable quantity of oval particles, hundreds of which, taken together, are not equal to the size of a grain of sand. They are of a pale red colour, and I take them to

be the spawn or eggs. Notwithstanding my most diligent examination of these creatures, I never could discover any difference of sexes; and it seems to me most probable, that they are of that species called Hermaphrodites, or every one equally prolifick; at least, none has ever fallen into my hands which appeared plainly to be a male. The tail, though of the same texture with the rest of the body, is much tenderer, breaking or tearing upon the slightest touch.

The parts in several animals wherein I have hitherto found these creatures, are only the vessels, tubes, and channels wherein the gall is formed and collected, though most commonly in the liver and here they may be said to swarm, producing grievous swellings, callosities, contorsions, and sinuses in the part; and cavities which will be often found an inch and an half in diameter. In these parts these noxious animalcules are found in heaps, and the places where they lie become hard and cartilaginous. In the small gall-ducts they lie longitudinally, and sometimes rolled or curled up together; and I believe that many persons have hereby been led into a mistake respecting the shape of them, describing them to be oblong, round worms; but in truth, however closely they may be thus rolled up, they will spread open again, even after they are dead, upon being thrown into warm water, for then they recover their flat shape, but at the same time they become rather of a paler colour than they originally were.

These creatures are commonly found in great numbers, though in this particular they vary much, as it depends on their having had more or less time to propagate; I have taken out of one liver, 870 in number, besides many fragments, and exclusive of those which were cut in pieces or destroyed in opening the liver. And in another liver I have seen but ten or twelve.

They are found in many different kinds of beasts. I have been

informed by Hunters, that they have found them in Stags, wild Boars, and other kinds of game, both great and small. I myself have seen them frequently in Calves, and once in a young Bullock. Sheep are infested by them even from the womb of the parent, and Lambs of a year old and upwards, as well as aged Sheep.

As to the production and propagation of these animalcules, I consider as idle tales, what some writers assert, of their being generated by putrefaction or decayed substances, immoderate wet or heats, and other equally senseless imaginations; and I lay it down as a certain truth, that these, as well as all other small living creatures, are produced from their like, by the means of eggs, seed, or spawn, according to the nature implanted in them at their first creation. And it seems to me most probable, that these animals, with their eggs, find their way into the bodies of Sheep, (and which we may suppose to be the case also with other insects and their eggs,) in the following manner; namely, that in wet summers and autumns these animalculæ, which are originally bred on the surface of the earth, may, with the water in which they live, be swallowed by the Sheep; and I have been confirmed in this opinion by conversing with Countrymen, Huntsmen, and Butchers, on the subject. But I am not of the opinion that after being swallowed, they do themselves force their way out of the stomach and bowels into the gall-bladder; I rather conclude, from reason and my own experience,* that their spawn or eggs may, with the oily part of the chyle in the infected beast

* It must seem strange to us that a creature, originally bred in the water, should find a proper receptacle for its life and growth in the warm bowels of an animal; and yet we daily see leeches, which are also bred in the water, and perfectly cold themselves, suck the warm blood of the human species with an avidity scarcely to be paralleled. But, as Mr. Leeuwenhoek, in one part of his works observes, we may wonder at these operations of nature, but admiration, and nothing more, will be the result of our cogitations.

be carried into the vessels of the gall bladder, and there fix themselves; forasmuch as these vessels are lined with a slimy and tenacious substance, and also because the gall is not like the blood, in continual circulation, but is retained in its vessels, or emitted, as the calls of the animal œconomy require. Again, they are found swarming in the liver, where they produce tumours and callosities, and cause the colour of it to change. And it seems to me not at all surprizing that these animalcules should live and be nourished in the juices of the gall, for every living creature has a situation and species of food peculiar to itself. Sea-fish die in fresh, and river-fish in salt water. A worm cannot live in the air, and a fowl expires in the earth. What wonder is it then that the creature of which we are treating, when introduced into the body of another animal, should find its peculiar place of life, growth, and increase in the vessels of the gall, and in the gall itself?

In the last place, like as we experience, that many living creatures are found in the human body, producing disease, pain, and death itself; so it is my opinion, that the animalcules of which I have been treating, and which are some times found together by thousands, may produce the following mischievous consequences:

First, the extraordinary distension of the parts where they harbour, as well by the growth and increase of their own bodies, as by the multiplication of their species or brood.

Secondly, by their biting or gnawing the parts they infest, so as at length to break or destroy their texture; and thus wholly, or in part, render them incapable of performing their functions.

Thirdly, by forcing their bodies into the small tubes, and vessels, whereby the delicate frame of those tender parts is torn asunder.

Fourthly; by obstructing the passages in the vessels, whereby the circulation of the juices is prevented, and an inflammation ensues.

Fifthly, by devouring and consuming the nutritive juices, whereby the adjacent parts are deprived of their support and nourishment.

Sixthly, by clogging the vessels with their excrements, their eggs or spawn, and the bodies of such of the animalcules themselves as die, whereby the motion of those parts being impeded, the most fatal consequences follow.

There are many other ways in which these creatures may prove noxious to animals, but those which I have here enumerated may be sufficient to give an idea of the rest.

He, then, who can find out and practise a method whereby, without injury to the parts of the body were these vermin harbour, can prevent their gnawing the parts, their creeping about in the intestines, and what is worse, their dying there; or rather, can discover how to expel them while alive out of the body, will in this respect bid fair to effect a cure. It is laid down as a truth, that a distemperature of the blood and juices, whether proceeding from an ill constitution thereof, or from an interruption in the circulation, can cause many diseases and their ill consequences: but must it therefore be deemed unreasonable to attempt proving, that animalcules being found in the juices, or even in the more solid parts of the body, may also produce diseases? The first of these points is mere matter of theory or argument; of the second, more certain proofs can be brought; consequently, it seems more rational, that those persons, who altogether rely upon their experience, should, in their enquiries, diligently investigate the reasons on which they found their opinions.

I forbear to say any more on this subject, forasmuch as what I have written is only for the improvement of medical knowledge, and as an incentive to the laborious enquirers after new discoveries in science, the field of which is indeed indefinite.



ADDITION, BY THE TRANSLATOR.

IT is proper to inform the Reader, that the preceding Essay has not Mr. Leeuwenhoek for its author, but is taken from a letter written to him on the subject by G. Bidloo, a professional Gentleman at Leyden, under date of the 21st March 1698, and published in the Dutch Edition of Mr. Leeuwenhoek's Works, though it does not appear in the Latin Version; but as the subject is interesting, and probably this Essay has not before appeared in any other than the Dutch language, the Translator thought that it might be acceptable to the English Reader.

Since the perusal of this Essay, the Translator has had opportunities of conversing with several judicious Gentlemen, who are conversant in the grazing of Sheep, from whom he has collected the following particulars:

That in very wet seasons, particularly towards the latter end of the year, a species of grass springs up in the low and wet lands, by feeding on which the Sheep are supposed to contract the distemper called the Rot. That if the rains do not abound until after the winter frost has been experienced, the Sheep are not then obnoxious to this disease, but otherwise, if a wet season precedes the frost; and lastly, that Sheep infected with this disease, do for a time appear fat and healthy, but when the disorder gets to a height, they fall away rapidly.

These particulars seem to prove, that the disease called the Rot in Sheep, does in fact proceed from the animal described in the preceding Essay, which being bred in the water, and adhering, with its eggs, to the grass growing in watery places is swallowed by the Sheep. And it is probable that when the frost precedes a wet season, the animalcules and their eggs are killed by the frost, and consequently the Sheep escape; we may also conclude, that while this noxious animalcule is in an infant state in the bowels of the Sheep,

it may not be particularly injurious, but when it arrives at a size to prey upon the liver, first a sickness, and wasting in the animal, and afterwards death must ensue ; and the Translator has been informed by a gentleman's Gamekeeper, that he has frequently found Hares dead of this disease, and that upon opening them, hundreds of the animalcules were found in their livers.

These particulars the Translator thought proper to notice, leaving it to those who are qualified, to exercise their medical skill in the discovery of a remedy for this fatal distemper.

The animalcule before described is called in some countries a Fluke, in others a Loop, but most generally a Flounder, probably from the resemblance it bears to the fish of that name.

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